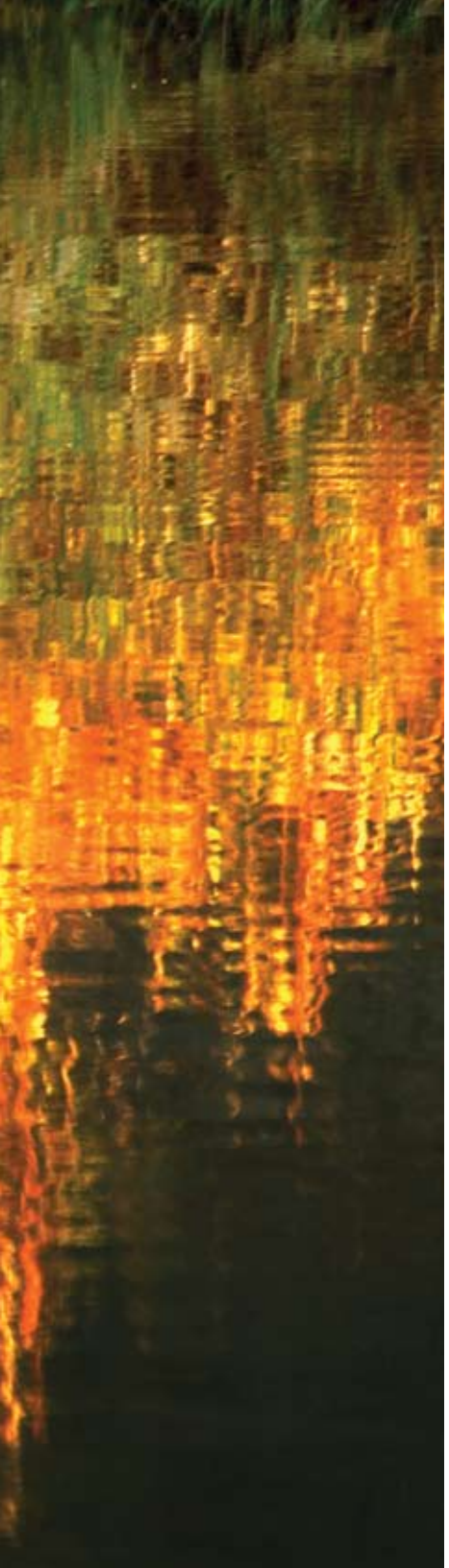
"How water is used would impact the health and sustainability of the regional ecosystem."



# THE ENVIRONMENT

## Air Quality

### *Why is this important?*

Good air quality is vital for the health of residents, nature and the economy. Human health effects of air pollution can range from lung irritation to cancer and premature death. Ecological effects include damage to crops and contamination of waters. Degradations in human and ecological health often adversely impact economic well-being.

### *How are we doing?*

The SCAG region includes four air basins: South Coast, Mojave Desert, Salton Sea and South Central Coast (Ventura County portion) (see Map on the next page). An air basin generally has similar meteorological and geographical conditions throughout.

The U.S. Environmental Protection Agency (EPA), shortly after its creation in 1970, developed regulations targeting six "criteria" pollutants that adversely affect human health and welfare: ozone, particulate matter (PM), carbon monoxide (CO), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), and lead. Among these, the first three pollutants have exceeded federal health standards for many years, with various parts of the SCAG region showing moderate to extreme levels of pollution except for CO in the past few years. Because of their significance, this report focuses on the first three pollutants.

*Air quality trends are affected by emissions as well as meteorology (weather) and terrain. In particular, meteorology causes year-to year changes in air quality trends that can mask the impacts of emissions.* For example, an analysis of daily weather conditions in the South Coast Air Basin found that 1981, 1994, 1995 and 2003 had many days when the weather was likely to promote high levels of ozone.[1]


Kings
Tulare
Inyo
Nevada
San Luis Obispo
Kern
Santa Barbara
South Central Coast Air Basin
Ventura
Los Angeles
San Bernardino
Mojave Desert Air Basin
South Coast Air Basin
Riverside
Orange
PACIFIC
OCEAN
San Diego
Salton Sea Air Basin
Imperial
Arizona
Mexico
AIR BASINS
in the SCAG Region
MDAB
SCAB
SSAB
VC SCCAB
Ports
Major Airports
Ports of Entry
Freeway
Highway
County
N
Source: California Air Resources Board and Air Districts

*However, long-term trends are closely related to the changes in emission levels.* In addition, air masses can move from basin to basin. As a result, pollutants such as ozone and particulate matter can be transported across air basin boundaries.

While some pollutants, such as CO, are directly emitted, others are formed in the atmosphere from precursor emissions. Such is the case with ozone, which is formed in the atmosphere when reactive organic gas (ROG) and oxides of nitrogen (NOx) precursor emissions react in the presence of sunlight. Particulate matter (PM) which includes $PM_{10}$ and $PM_{2.5}$ is a complex pollutant that can either be directly emitted from dust or soot or formed in the atmosphere from precursor emissions such as NOx, ROG and oxides of sulfur (SOx).

Air pollution consistently ranks high among public concerns in Southern California, and control efforts have been a high priority in recent decades. *Despite significant improvements in the past two decades, the South Coast Air Basin still has some of the worst air quality in the nation. Specifically, the South Coast has the highest maximum concentration of ozone and $PM_{2.5}$ in the nation.*

## Ozone

Beginning in June 2005, the national one-hour ozone standard was revoked and replaced by a new 8-hour ozone standard that is more health protective. The new ozone standard is more stringent than the old standard but allows longer timeframe for attainment.[2] Currently, all four air basins in the region are designated as non-attainment areas for 8-hour ozone. The State Implementation Plan (SIP) for ozone is due to U.S. EPA in June 2007.

Ozone is a colorless and poisonous gas. Ground level ozone is a major component of urban and regional smog. Ozone is a strong irritant, which can reduce lung function and aggravate asthma as well as lung disease. Repeated short-term ozone exposure may harm children's developing lungs and lead to reduced lung function in adulthood. In adults, ozone exposure may accelerate the natural decline in lung function as part of the normal aging process.

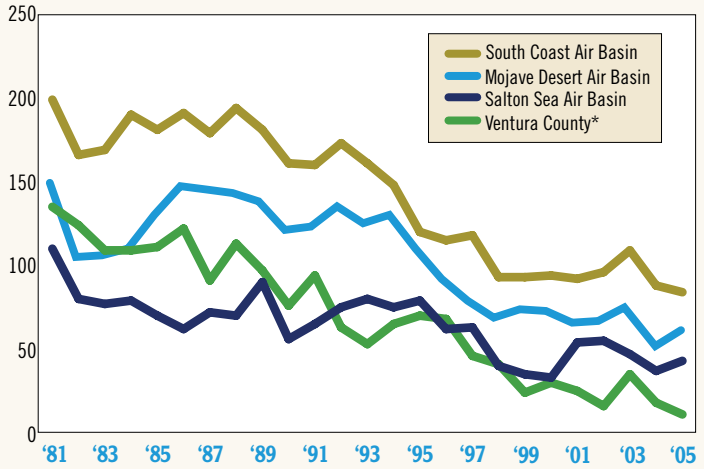
*In 2005, ozone pollution improved slightly in the South Coast Air Basin and Ventura County but worsened somewhat in the Mojave Desert and Salton Sea air basins.* In the most populous and polluted South Coast Air Basin, the number of days exceeding the federal 8-hour ozone standard decreased slightly from 88 days in 2004 to 84 days in 2005, the lowest since 1976 (Figure 51). However, ozone improvements have shown signs of leveling off since 1998. The maximum 8-hour ozone concentration in the South Coast Air Basin decreased very slightly from 0.148 ppm (parts per million parts of air) in 2004 to 0.145 ppm in 2005, about half of the 1985 level.[3] The number of days for health advisories in the South Coast Air Basin, however, increased from 4 to 11 days between 2004 and 2005.[4]

Between 2004 and 2005, Ventura County also achieved reductions in the number of days exceeding the federal 8-hour standard, from 18 to 11 days. However, during the same period, both the Mojave Desert and the Salton Sea air basins experienced increases in the number of days exceeding the federal 8-hour standard, from 49 to 55 days and 37 to 43 days respectively. *Within the region, the Central San Bernardino Mountain area surpassed the federal 8-hour ozone standard for a total of 69 days in 2005 followed by the Santa Clarita Valley (47 days) and Banning Airport area in Riverside County (39 days).*[5]

Figure 51

**Ozone Pollution in Non-attainment Air Basins**

(Number of Days Exceeding Federal 8-hour Standard)



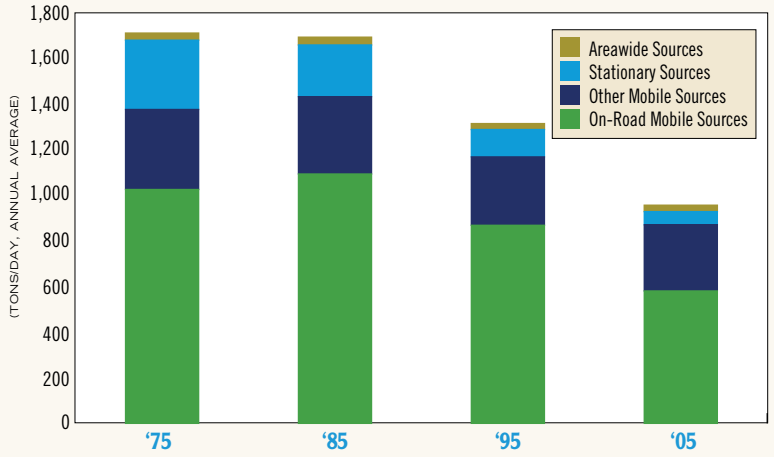

** Ventura County is part of the South Central Coast Air Basin*
*Source: California Air Resources Board and South Coast Air Quality Management District*

Emissions of ozone precursors ROG and NOx in the South Coast Air Basin are generally following a downward trend (Figure 52). For example, total emissions of NOx were reduced from over 1,700 tons/day in 1975 to

about 950 tons/day in 2005. This is primarily due to the reductions from on-road mobile sources as more stringent vehicle emission standards have been implemented and as newer, less-polluting vehicles become a larger share of the fleet. *In 2005, heavy duty trucks were responsible for 320 tons/day of NOx, a third of the total NOx emissions in the South Coast Air Basin.* As to "other mobile sources", major NOx contributors are off-road combustion equipment, ships and trains. The NOx emissions from off-road combustion equipment have been decreasing and offset the increases from ships. NOx emissions from stationary sources (e.g., electric utilities) in the air basin have declined substantially since 1975, despite a nationwide increase in emissions from electric utilities in the same period. These large reductions are primarily due to increased use of natural gas as the principal fuel for power plants, and control rules that limit NOx emissions.

Figure 52

**NOx Emissions in the South Coast Air Basin**




*Source: California Air Resources Board*

The California Air Resources Board has identified the South Coast Air Basin as a transport contributor to several downwind air basins – the Mojave Desert, Salton Sea, San Diego and the South Central Coast air basins. As ozone precursor emissions in the South Coast Air Basin decline further, the transport impact on the downwind air basins should also decrease.

## $PM_{10}$

$PM_{10}$ is particulate matter with diameter of 10 micrometers (um) or smaller. The diameter of a human hair is about 60 micrometers. Exposure to particulate matter aggravates a number of respiratory illnesses and may even cause early death in people with existing heart and lung disease. Both long-term and short-term exposure can have adverse health impacts.

Three air basins in the region have been designated as non-attainment areas for $PM_{10}$: the South Coast, Salton Sea and Mojave Desert. The annual average indicator provides a measure of long-term exposure to particulate matter that could contribute to breathing disorders, reduce lung function, and curtailed lung growth in children. It should be noted that, on September 21, 2006, the U.S. EPA revoked the $PM_{10}$ annual standard but retained the 24-hour standard. However, in tracking the performance of the region in 2005, both the annual and 24-hour $PM_{10}$ standards are used.

Since 1987, the South Coast Air Basin has been exceeding the Federal annual average standard of 50 ug/$m^3$ (micrograms per cubic meter of air) but with a general trend toward improvement (Figure 53). In 2005, there continued to have a slight reduction from 2004 in the $PM_{10}$ annual average in the South Coast Air Basin, from 8 percent to 4 percent above the federal standard. Exceedances of the federal annual standard in the South Coast Air Basin were confined to Riverside County with a maximum of 52 ug/$m^3$ (or 104 percent of the federal standard).[6] On an annual basis, directly emitted $PM_{10}$ emissions contribute approximately 65 percent of the ambient $PM_{10}$ in the South Coast Air Basin. Among the directly emitted $PM_{10}$ emissions in 2005, 46 percent

were from paved road dust while another 14 percent were from construction and demolition.[7] Directly emitted $PM_{10}$ emissions, though declining by about 20 percent between 1990 and 2005, are projected to increase slightly (about 5 percent) by 2020.[8]

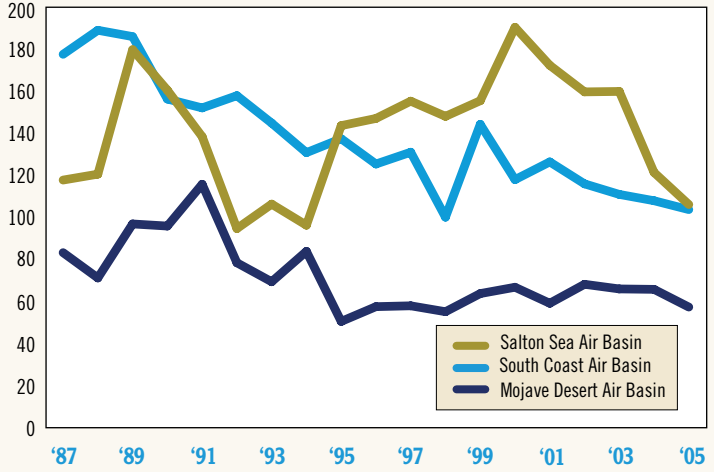
In the Salton Sea Air Basin, the $PM_{10}$ pollution level has been fluctuating since 1987. The Salton Sea Air Basin has contained the highest level of $PM_{10}$ annual average within the SCAG region since 1995. Between 2004 and 2005, the annual average of $PM_{10}$ pollution in the Salton Sea Air Basin dropped significantly from 22 percent to about 6 percent over the federal standard. Among the directly emitted $PM_{10}$ emissions in 2005, 70 percent were from fugitive windblown dust and another 14 percent were from unpaved road dust.

In the Mojave Desert Air Basin, $PM_{10}$ pollution level has been below the federal annual average standard since 1992. Among the directly emitted $PM_{10}$ emissions in 2005, 58 percent were from unpaved and paved road dust while only 10 percent were from fugitive windblown dust.

*In 2005, the number of days exceeding the federal 24-hour standard (150 ug/$m^3$) for $PM_{10}$ decreased slightly in the Salton Sea Air Basin, from 8 to 6 days (Figure 54).* The number of days with an unhealthy level of $PM_{10}$ describes the chronic extent of $PM_{10}$ pollution. *In both 2004 and 2005, neither the South Coast nor Mojave Desert air basin had any exceedance regarding the federal 24-hour standard.*

Figure 53

**$PM_{10}$ in Non-attainment Air Basins**
**(Percent of Federal Annual Average Standard*)**




** Above 100 percent means exceeding the federal standard. Also $PM_{10}$ condition may be impacted significantly by natural events or pollution transport.*

*Source: California Air Resources Board*

Figure 54

### $PM_{10}$ Pollution in Non-attainment Air Basins

Days Exceeding Federal $PM_{10}$ 24-hour Standard

| AIR BASINS | 2003 | 2004 | 2005 |
|---|---|---|---|
| Mojave Desert | 8 | 0 | 0 |
| Salton Sea | 28 | 8 | 6 |
| South Coast | 6 | 0 | 0 |

*Source: California Air Resources Board*

California state standards for $PM_{10}$ are significantly more stringent than federal standards due to greater consideration given to the potential health impacts. Specifically, the state annual average standard for $PM_{10}$ of 20 ug/$m^3$ is only 40 percent of the federal standard of 50 ug/$m^3$. In 2005, both the Salton Sea and South Coast continued to significantly exceed the state annual average standards. In addition, the state 24-hour standard for $PM_{10}$ of 50 ug/$m^3$ is only a third of the federal standard of 150 ug/$m^3$. In 2005, the Salton Sea Air Basin exceeded the state $PM_{10}$ 24-hour standard on 160 days, while the South Coast Air Basin exceeded on 198 days.[9]

### $PM_{2.5}$

$PM_{2.5}$ is a subgroup of finer particles within the classification of $PM_{10.}$ They pose increased health risks because they can penetrate deeper in the lung than $PM_{10}$ and contain substances that are particularly harmful to human health.

The U.S. EPA promulgated area designations for $PM_{2.5}$ for the first time in early 2005. Within the SCAG region, only the South Coast Air Basin was designated as a non-attainment area with 2014 as the required attainment year. The State Implementation Plan (SIP) for $PM_{2.5}$ is due to U.S. EPA in April 2008, but will be submitted in June 2007 along with the ozone SIP because many of the control strategies that reduce $PM_{2.5}$ precursor emissions are also needed to help attain the 8-hour ozone standard. State non-attainment designation is more encompassing and includes, in addition to the South Coast, the Western Mojave Desert Air Basin and Ventura County.

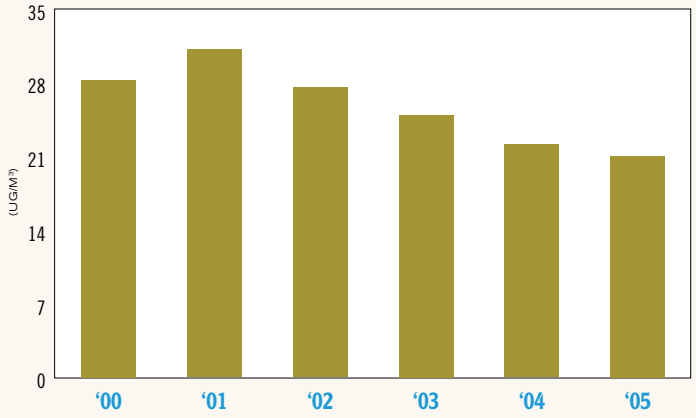
*While the annual average concentration of 21 ug/$m^3$ in the South Coast Air Basin declined in 2005 from the previous year (22.1 ug/$m^3$), it continued to exceed the federal standards of 15 ug/$m^3$ (Figure 55).* Specifically, 12 of the 19 monitoring stations in the basin showed exceedance, ranging from coastal cities to inland valleys. Nevertheless, the annual average $PM_{2.5}$ concentration in the South Coast Air Basin in 2005 was the lowest since monitoring began in 1999.

*$PM_{2.5}$ particles being smaller than $PM_{10}$ particles are more difficult to control.* In a recent action by the U.S. EPA on September 26, 2006, the federal 24-hour $PM_{2.5}$ standard was revised to be significantly more stringent, lowered from 65 ug/$m^3$ to 35 ug/$m^3$. In 2005, while the South Coast Air Basin did not have any exceedance of the federal 24-hour standard for $PM_{10}$, it exceeded the (old) federal 24-hour standard for $PM_{2.5}$ on 6 days sampled, a slight decrease from 7 days sampled in the previous year.[10]

On an annual basis, directly emitted $PM_{2.5}$ emissions contribute approximately 40 percent of the ambient $PM_{2.5}$ in the South Coast Air Basin. Among the directly emitted $PM_{2.5}$ emissions, about 55 percent are from areawide sources, while 33 percent are from mobile sources and another 12 percent are from stationary sources. $PM_{2.5}$ emissions, though declined by about 22 percent between 1990 and 2005, are projected to remain relatively stable until 2020.

Figure 55

**$PM_{2.5}$ Pollution in the South Coast Air Basin**
(Annual Average Concentration*)




** Federal annual average standard for $PM_{2.5}$ is 15 ug/$m^3$*
*Source: South Coast Air Quality Management District*

### Carbon Monoxide

In December 2002, the South Coast Air Basin met federal attainment standards for CO (with no violation in 2001 and the one day allowable exceeding the federal standard in 2002). *The basin continued to have no violation for CO from 2003 to 2005.* During the past two decades, peak 8-hour CO levels decreased in the South Coast Air Basin from 28 ppm in 1985 to 5.9 ppm in 2005 (in south central Los Angeles County).[11] Even though the South Coast has met the attainment requirements since 2002, it has not been officially redesignated as an attainment area. Continuing reductions from motor vehicle control programs is expected to continue the downward trend in ambient CO concentrations.

## Water Resources

### Total Water Use

#### *Why is this important?*

Water is essential to human life. With the continuing increase of population in the region, ensuring reliable water resources to meet demand and maintaining water quality are vital goals for all of Southern California. In addition, how water is used would also impact the health and sustainability of the regional ecosystem.

#### *How are we doing?*

The SCAG region depends on both imported and local sources to meet its demand for water. This includes imported water from the Colorado River via the Colorado River Aqueduct, the State Water Project via the California Aqueduct, and the eastern Owens Valley/Mono Basin in the Sierra Nevada via the Los Angeles Aqueduct. *Together, depending on the rainfall level, imported water generally accounts for about 70 to 75 percent of the regional water supply.* The remaining 25 to 30 percent comes from local surface and ground water and from reclaimed water sources.[12] *It is important to note that available water from all three imported sources may be reduced in the future as other users and uses place greater demands on these sources.* For example, environmental and water quality needs in the Delta and Owens River/Mono Basin systems affect import water supply quantity, quality and reliability. In addition, the Colorado River basin has experienced a five-year drought that is unprecedented in recorded history, while total water demand in its basin continues to rise because of population and economic growth. The Colorado River Water is perhaps the most critical and uncertain element of the water resource planning in Southern California.

In addition, the region also needs to assess and plan for impacts of global climate change (as further discussed in the Energy Section), as well as the cost of replacing aging infrastructure. *Some of the most significant impacts from global climate change will be on water resources, impacts that are of special concern to the SCAG region where water scarcity and quality are already of great concern.*

Within the SCAG region, the Metropolitan Water District (MWD) is the largest urban water supplier. Its service area includes more than 15 million residents in the region (Figure 56). In recent years, MWD has provided about half of the municipal, industrial and agricultural water used in its service area.

Figure 56

### Population Within Water District Service Area

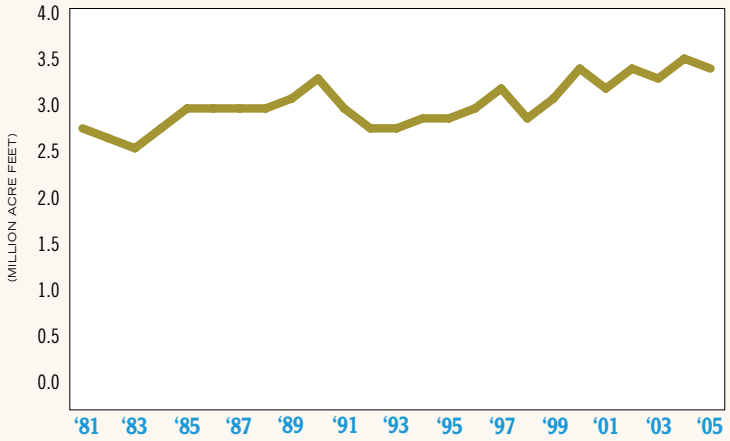
| COUNTY | MWD | Non-MWD |
|---|---|---|
| Imperial | 0% | 100% |
| Los Angeles | 92% | 8% |
| Orange | 100% | 0% |
| Riverside | 72% | 28% |
| San Bernardino | 41% | 59% |
| Ventura | 72% | 28% |
| REGION | 85% | 15% |

*Source: Metropolitan Water District*

In 2005, total water consumption was over 3.4 million acre-feet. The 2005 level was only 6 percent higher than the 1990 level (a dry year), despite an increase of almost 3.5 million (24 percent) residents since 1990 (Figure 57). Within the MWD service area in the SCAG region, total water consumption did not experience significant increases for several years in the mid-1990s due to the recession, wet weather, conservation efforts, and lingering drought impacts. Of total consumption, only 7.5 percent was for agricultural purposes and the rest was for urban (municipal and industrial) uses.

Figure 57

### Total Water Consumption*
(Metropolitan Water District Service Area)




**Within the SCAG region. Total water consumption includes municipal/industrial and agricultural uses.*
***One acre foot equals 325,851 gallons.*
*Source: Metropolitan Water District including projected data for 2005*

In recent years, the region has developed an array of local projects to complement imported water supplies. They include surface water storage, groundwater storage and conjunctive use, water recycling, conservation, brackish water desalination, water transfer and storage, and infrastructure enhancements. Within the MWD service area, water conservation programs are estimated

to conserve about 736,000 acre-feet of water in 2005, almost tripled the 1990 level at 250,000 acre-feet.[13] Some of the major river systems in Southern California have been developed into systems of dams, flood control channels and percolation ponds for supplying local water and recharging groundwater basins. For example, the San Gabriel and Santa Ana rivers capture over 80 percent of the runoff in their watersheds.

## Per Capita Urban Water Use

### *Why is this important?*

Water consumption per capita is important when looking at a city or county's growth projections in order to maintain a safe yield per person and sustain community well-being.

### *How are we doing?*

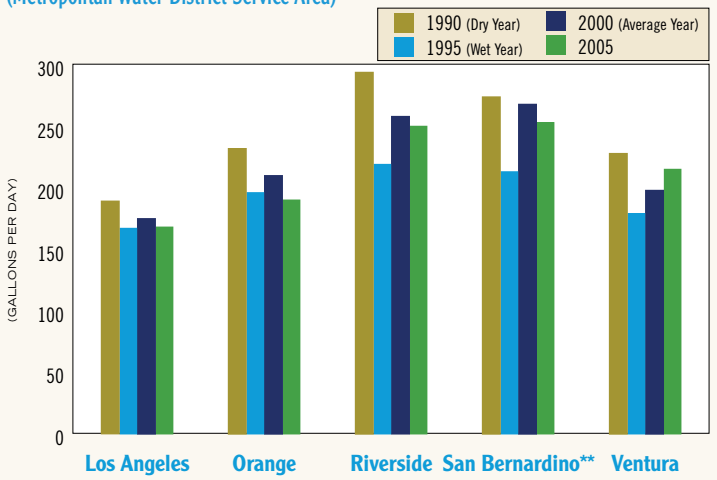
Urban water use includes residential, commercial, industrial, fire fighting and other uses. Hence, per capita urban water use consists of more than the amount of water used directly by an individual. Since 1991, per capita urban water use has generally been below the pre-drought levels. While 1990 was a dry year, 1995 was a wet year and 2000 represented an average year. In 2005, per capita urban water use declined slightly from the 2000 level in each county in the region except for Ventura County (Figure 58).

An important factor contributing to the overall decline in per capita urban water consumption is the development of various conservation programs and practices. These include retrofitting with water efficient technology for showerheads and toilets and changing landscaping practices toward drought-tolerant plants. In addition, implementation of new water rate structures has helped suppress growth in per capita water demand.

Figure 58

**Per Capita Urban Water Consumption***

(Metropolitan Water District Service Area)




**Not including agricultural use. 2005 data are estimates by MWD.*
***San Bernardino's portion includes only 41% of the County's total population, significantly less than other counties.*

*Source: Metropolitan Water District, 2005 Regional Urban Water Management Plan.*

In Southern California, much of the variation in per capita water use among counties can be attributed to climate differences. Within the region, the Inland Empire counties continued to maintain higher per capita urban water consumption rates than coastal counties. For example, in 2005, per capita urban water consumption per day in San Bernardino and Riverside counties was 250 and 253 gallons respectively in contrast to 190 gallons in Orange County and 168 gallons in Los Angeles County. This partly reflects higher landscape water use due to warmer and dryer climate conditions. In addition, a single family unit has higher per capita water use than a multi-family unit. The Inland Empire has much higher share (72 percent) of single-family residential units than Los Angeles County (55 percent) or Orange County (63 percent).

## Beach Closure

### *Why is this important?*

When the ocean waters off a beach contain high concentrations of certain bacteria, they become unsafe for swimming and other recreational uses. In 1999, the California Department of Health began monitoring all beaches which have more than 50,000 annual visitors and have outflows from storm drains, rivers, or creeks. Closures or advisories are issued for beaches that fail to meet the state's standards for various sources of bacterial pollution.

### *How are we doing?*[14]

*Between 2004 and 2005, the total number of beach closing/advisory days increased from 2,860 to 3,278 among the 98 beaches monitored in the region.* The increase of 15 percent of beach closing/advisory days in the region was less than that at the state level during the same period, from 3,985 to 5,175, or 30 percent.

*In 2005, Los Angeles County experienced 2,213 beach closing/advisory days, the highest number in the past 5 years and also the highest among all California counties for the third consecutive year.* Following Los Angeles County were Santa Barbara (653 beach closing/advisory days), Orange County (631 beach closing/advisory days), and Ventura County (434 beach closing/advisory days). Polluted urban stormwater runoff continues to be the largest source of pollution and the predominant cause of beach closing across the state.

Between 2004 and 2005, the number of beach closing/advisory days in Los Angeles County increased significantly from 1,469 to 2,213, a 51 percent increase following the 1 percent increase during the previous period. Almost 99.7 percent of total beach closing/advisory days in the county in 2005 were due to elevated bacterial levels from unknown sources. The remaining 0.3 percent was due to known sewage spills.

Orange County experienced a 33 percent decrease from 939 to 631 beach closing/advisory days between 2004 and 2005, after a 26 percent decrease during the previous period. Similar to conditions in Los Angeles County, 81 percent of total beach closing/advisory days in Orange County were due to elevated bacterial levels from unknown sources. Ventura County also experienced a slight decrease of 4 percent from 452 to 434 beach closing/advisory days between 2004 and 2005, after a 37-percent reduction during the previous period. Among the total beach closing/advisory days, about 52 percent were preventive due to debris on the beach and 35 percent were from unknown source of contamination.

## Solid Waste

### *Why is this important?*

Disposing of waste in landfills is not only costly but, if not treated properly, could have dire impacts on the ecosystem and human health. For example, decomposition of waste in landfills releases methane into the atmosphere, a significant contributor to global warming. Hence, a sustainable society would minimize the amount of waste sent to landfills by reducing, recycling or reusing the waste generated as much as possible.

### *How are we doing?*

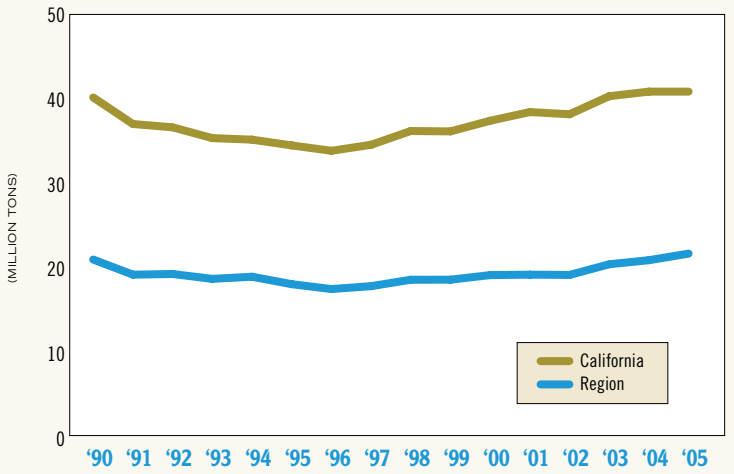
The 1989 California Integrated Waste Management Act set the goal of 50 percent diversion of each city and county's waste from landfill disposal by the year 2000. Diversion measures include waste prevented, waste re-used, waste recycled or waste composted. Waste diversion programs such as curbside recycling pickups, greenwaste collection, and municipal composting have

steadily increased the diversion rate. *At the statewide level, the diversion rate – the share of amount diverted out of the total waste generated - increased from 10 percent in 1989 to 53 percent in 2005.*[15] Hence among the 79 million tons of waste generated in California in 2005, over 42 million tons were diverted. Among the total waste generated, about 30 percent was organic matter, 22 percent was construction and demolition materials and 21 percent was paper.[16]

*In 2005, the total amount of waste disposed to landfills in the region reached 22.3 million tons, a slight increase of almost 1 million ton from 2004. It was also a higher level than any year since 1990 (Figure 59).* During the 1990s, waste sent to landfills in the region declined for several years, however, it has increased gradually since 1996. This is similar to the trend at the state level. Many landfills in the region are running out of capacity while environmental concerns make building new landfills or expanding existing landfills increasingly difficult.

Figure 59

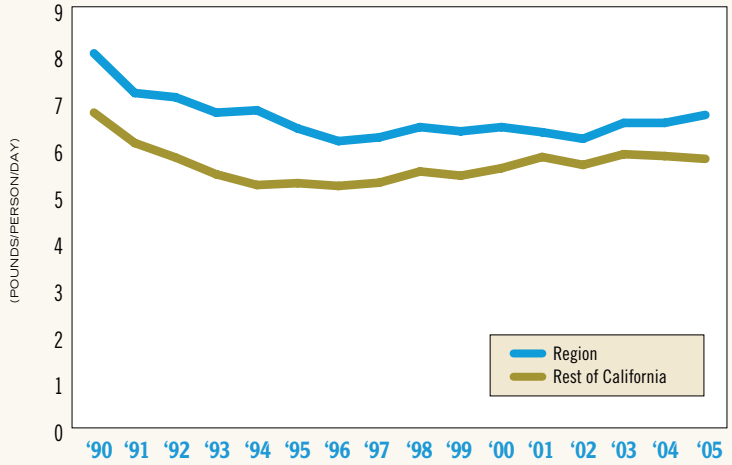
**Solid Waste Disposal at Landfills**




*Source: California Integrated Waste Management Board*

Figure 60

**Solid Waste Disposal in Landfills**




** Including residential and non-residential waste disposal.*

*Source: California Integrated Waste Management Board*

Since the passage of the Waste Management Act in 1989, the region began to make progress in reducing the amount sent to landfills on a per capita basis. In 1990, the region disposed about 8 pounds of solid waste per capita per day into the landfills, higher than that of the rest of the state of 6.8 pounds per capita per day. Various measures to implement the Act had reduced the per capita disposal rate in the region continuously to just over 6 pounds per day

(or almost 25 percent) in 1996, the lowest level since 1990. Since 1996, per capita disposal rates fluctuated somewhat and began to increase after 2002 to about 6.7 pounds per day in 2005. (Figure 60).

## Energy

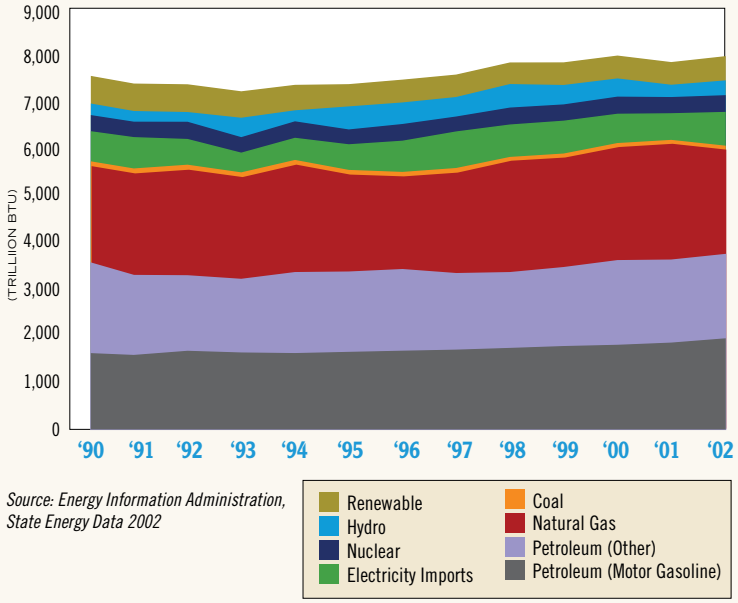
### *Why is this important?*

Energy is a critical input for the production processes of the regional and national economy. In addition, it is essential for everyday life. Reliance on fossil fuels contributes significantly to global warming that would result in adverse

impacts on many ecological systems, human health as well as the economy. Furthermore, strong dependence of foreign imports greatly reduces the reliability and security of this vital resource.

Figure 61

**California Energy Consumption Estimates by Source**




*Source: Energy Information Administration, State Energy Data 2002*

## *How are we doing?*

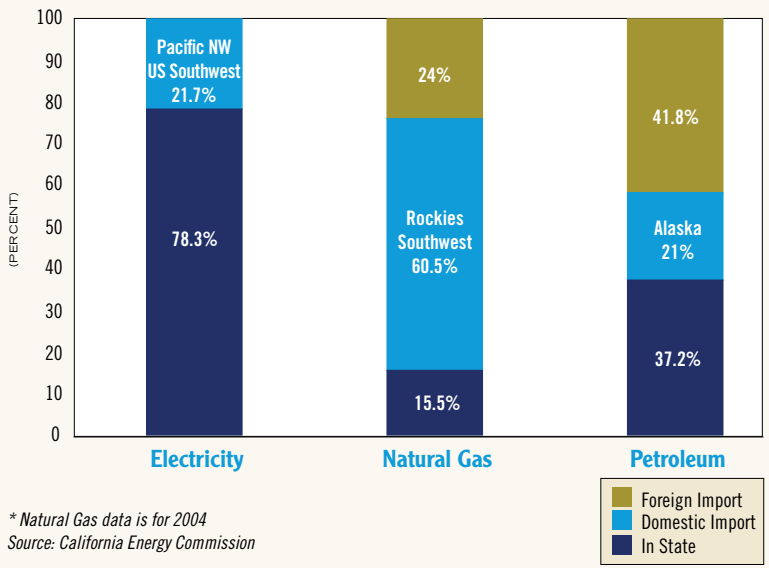
*Energy use in California is predominantly fossil-fuel based (i.e. petroleum, natural gas and coal), accounting for almost 85 percent of the total consumption (Figure 61). In addition, California obtains nearly two-thirds of its energy from outside its borders, including 63 percent of petroleum, 84 percent of natural gas and 22 percent of electricity uses (Figure 62).*

Based on the recent statewide inventory, petroleum accounted for about 47 percent of the total energy use, natural gas 28 percent and coal just below 1 percent.[17] In addition, imported electricity (9 percent of the total energy use) was produced mainly by coal or natural gas. Other sources of energy include renewable (6.5 percent), nuclear (4.5 percent) and hydroelectric power

(4 percent). As to the energy consumption by sectors in California, transportation sector is the largest user of 39 percent, followed by the industrial sector of 24 percent. Commercial and residential sectors each used about 18.5 percent. For major energy sources such as petroleum and natural gas, the SCAG region accounts for about 45 percent of the total state use and is expected to have similar consumption patterns to that of the state in the shares of different energy sources.

Figure 62

**California's Major Sources of Energy, 2005**




** Natural Gas data is for 2004*
*Source: California Energy Commission*

*At the national level, 86 percent of the total energy consumption is fossil-fuel based, almost the same proportion as that in California.* However, the nation relies much more on coal (23 percent) and less on natural gas (23 percent) and petroleum (40 percent) than California. In addition, within the non-fossil fuels, the nation also relies more on nuclear (8.5 percent).

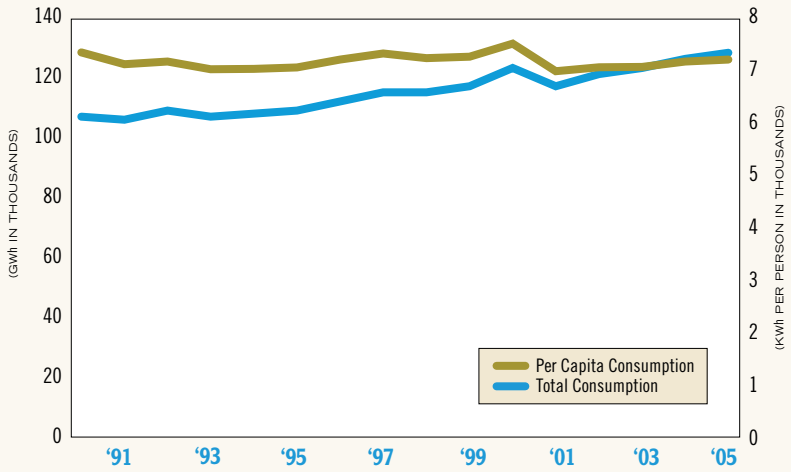
## Electricity Consumption

In 2005, the SCAG region consumed almost 128,000 gigawatt–hours (GWh) of electricity, about 48 percent of the total consumption in the state (Figure 63). In

the region, electricity consumption increased 15 percent during the 1990s. Total consumption declined in 2001 after the electricity crisis but since then has been increasing about 1.3 percent per year, roughly keeping pace with the population growth. Hence per capita electricity consumption in the region is projected to remain relatively constant over the next 10 years, at about 7,100 kilowatt-hours (kWh) per person, somewhat below the state average of 7,500 kilowatt-hours (kWh) per person.

Figure 63

## Electricity Consumption

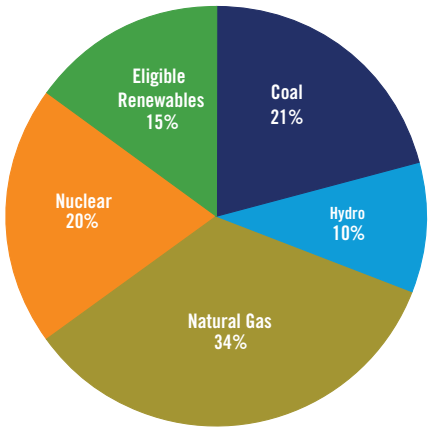



*Source: California Energy Commission*

Fossil fuels accounted for 55 percent of the total sources for electricity generation in Southern California, including natural gas (34 percent) and coal (21 percent) (Figure 64). Compared with the state's energy mix, Southern California had a higher share of renewable (15 percent vs. 11 percent). Both Southern California Edison and Los Angeles Department of Water and Power (LADWP) have set targets to reach 20 percent using renewable energy. Southern California relied more on nuclear (20 percent vs. 14 percent) but less on hydroelectric power (10 percent vs. 17 percent) than the state as a whole.

Figure 64

## Electricity Generation by Source, 2005




**Based on the combined mix of Southern California Edison and Los Angeles DWP*
*Source: California Energy Commission, Southern California Edison, Los Angeles Department of Water and Power, July 2006*

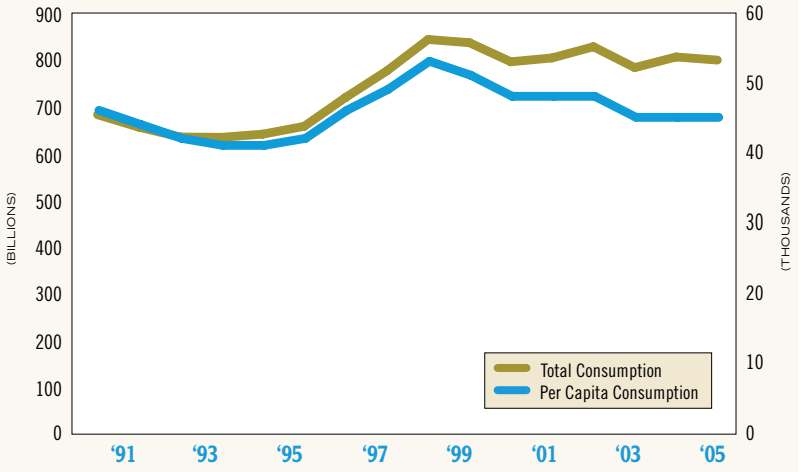
## Natural Gas Consumption

Californians consumed about 6.25 million cubic feet per day (MMcfd) of natural gas in 2005, half of which were used in electric generation. Only 16 percent of the total natural gas consumption was produced in California. The remaining was imported from the Southwest (36 percent) and Rockies (24 percent) in the U.S. and from Canada (24 percent). For natural gas use, the SCAG region is served by the Southern California Gas Company. A small portion of the region is served by a municipal gas utility, Long Beach Energy (part of the City of Long Beach). In 2005, the SCAG region consumed more than half (about 800 billions of cubic feet) of the natural gas consumed in the state excluding electricity generation use. Since 2000, the total non-electric generation use of natural gas in the region has been fluctuating slightly around 800-billion level and is projected to remain relatively constant for the next ten years. As to the per capita consumption of natural gas in the region, it has been on a gradually declining path since 1998 reaching about 45,000 cubic feet in 2005 (Figure 65).

In the region, residential was the largest user (33 percent) of natural gas followed by mining (32 percent). Among the total residential uses of natural gas, water heating and space heating each consumed about 44 percent.

Figure 65

**Natural Gas Consumption* (Cubic Feet)**




** Excluding the use for electricity generation*
*Source: California Energy Commission*

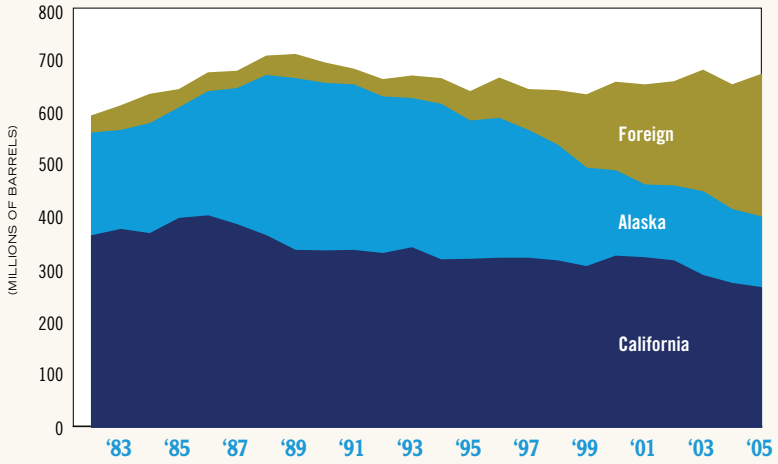
## Vehicle Fuel Consumption

*In 2005, more than 40 percent of the crude oil to California refineries came from foreign imports, exceeding for the first time the production from California (39.5 percent) (Figure 66). The share of foreign imports has been increasing rapidly from below 10 percent in 1995 to over 40 percent in 2005.* During the same period, production from California decreased from 50 percent to

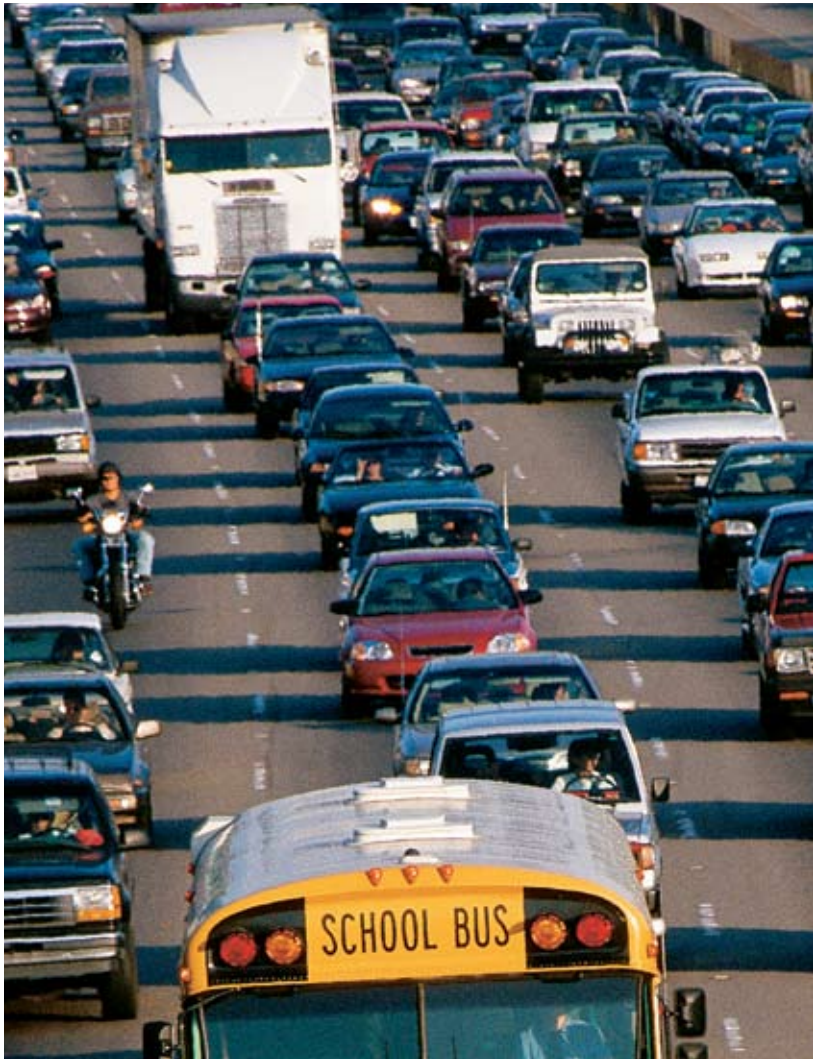
below 40 percent while imports from Alaska also decreased from 41 percent to 20 percent. Nationally, oil imports accounted for about 65 percent of the total consumption. Among the total petroleum use in the state, almost two-thirds were for vehicle fuel consumption including motor gasoline (54 percent) and distillate fuel (11 percent).

Figure 66

### Crude Oil Supply Sources To California Refineries



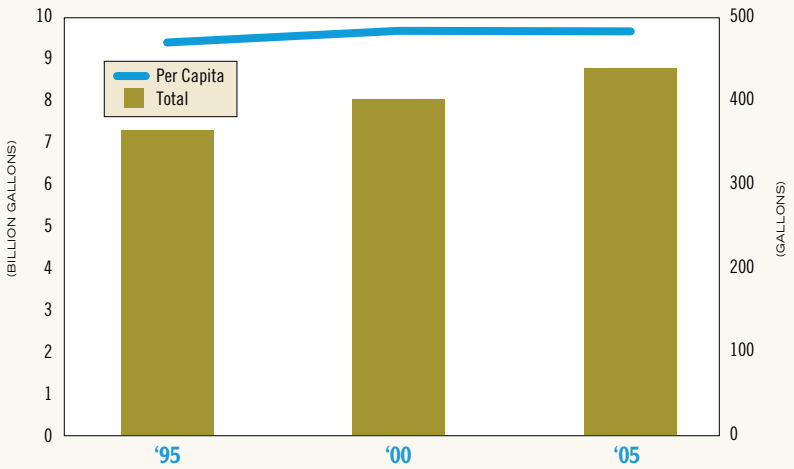

*Source: California Energy Commission*



In 2005, the region consumed about 8.8 billion gallons of vehicle fuels, an increase over 20 percent from a decade ago (Figure 67). However, per capita vehicle fuel consumption, though increasing slightly between 1995 and 2000, has since been relatively constant at about 485 (gasoline equivalent) gallons.

Figure 67

**Vehicle Fuel Consumption** (Gasoline Equivalent Gallons)



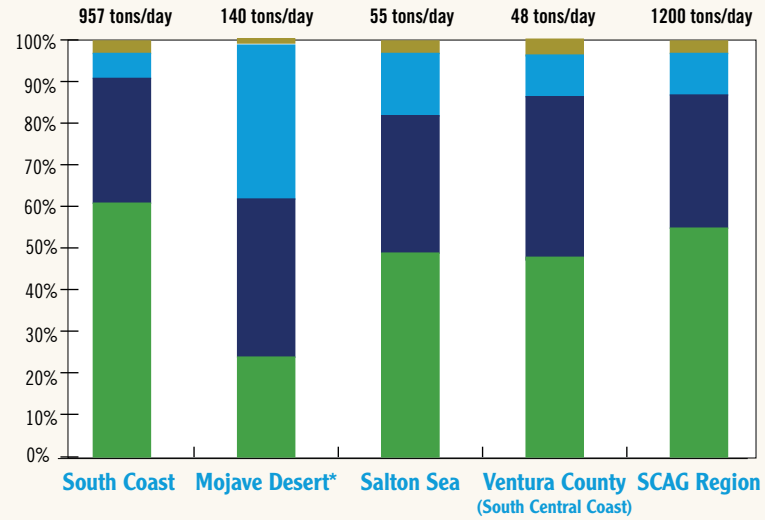

*Source: California Department of Transportation, 2005*
*California Motor Vehicle Stock, Travel and Fuel Forecast*

## Impacts on Global Warming

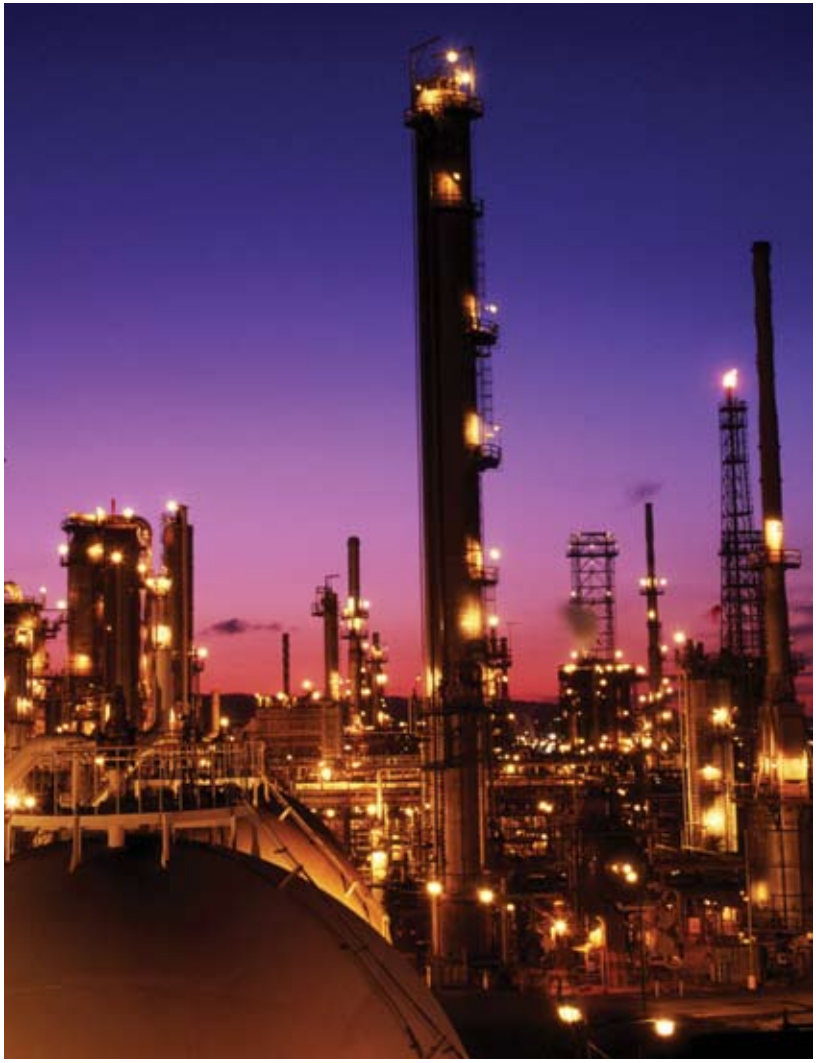
The combustion of fossil fuels (petroleum, natural gas and coal) to release their energy creates carbon dioxide ($CO_2$) emissions, the most significant greenhouse gas that affects global climate change and specifically global warming. This is in addition to fossil fuels' impacts on regional air quality including ozone pollution as described in the Air Quality Section. For example, the burning of fossil fuels for mobile sources in the region is responsible for more than 85 percent of total NOx emissions, a precursor of ozone pollution (Figure 68).

Figure 68

**NOx Emissions by Air Basin and Source, 2005**




** Excluding areas within Kern County that is outside the SCAG region*
*Source: California Air Resources Board*



Climate change is the shift in the "average weather" that a given region experiences. Currently, the Earth is warming faster than any time in the previous 1,000 years and the ten warmest years of the last century all occurred within the last 15 years and the global mean surface temperature has increased by $1.1^0$ F since the 19th century. Human activities are altering the chemical composition of the Earth's atmosphere through the release and build up of climate change emissions, predominantly $CO_2$, that absorb the heat. Specifically, the concentration of $CO_2$ in the atmosphere has risen about 30 percent since the late 1800s, and is estimated to reach between two to three times of its late 1800s level by 2100. Scenarios examined by national and international assessments indicate that temperatures in the U.S. will rise by about $5^0$ to $9^0$ F on average in the next 100 years.

Global warming poses a serious threat to the economic well-being, public health and natural environment in Southern California and beyond. The potential adverse impacts of global warming include, among others, a reduction in the quantity and quality of water supply, a rise in sea levels, damage to marine and other ecosystems, and an increase in the incidences of infectious diseases. Over the past few decades, energy intensity of the national and state economy has been declining due to the shift to a more service-oriented economy. California ranked fifth lowest among the states in $CO_2$ emissions from fossil fuel consumption per unit of Gross State Product. *However, in terms of total $CO_2$ emissions, California is second only to Texas in the nation and is the 12th largest source of climate change emissions in the world, exceeding most nations. The SCAG region, with close to half of the state's population and economic activities, is also a major contributor to the global warming problem.*

In 2000, California generated 473 million metric tons ($CO_2$ equivalent) emissions, an increase of 11 percent since 1990. It is projected to increase over 600 million metric tons ($CO_2$ equivalent) emissions in 2020 (Figure 69).

California Governor's Executive Order S-3-05 established statewide climate emission reduction targets as follows:

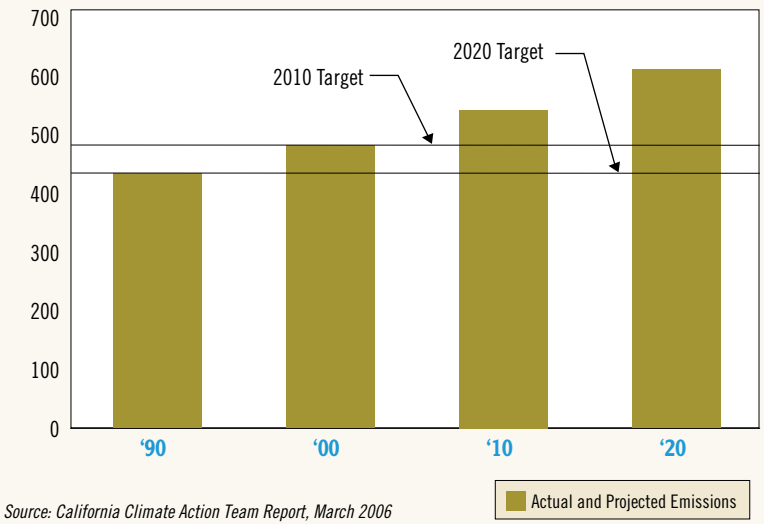
- By 2010, reduce emissions to 2000 levels;
- By 2020, reduce emissions to 1990 levels;
- By 2050, reduce emissions to 80 percent below 1990 levels.

In addition, state legislation AB 32 - California Global Warming Solutions Act passed into law in 2006 that also required the California Air Resources Board to adopt the statewide greenhouse gas emission limit equivalent to the statewide greenhouse gas emissions levels in 1990 to be achieved by 2020.

Among the climate change pollutants resulted from California's economic activities, 81 percent are $CO_2$ emissions from fossil fuel combustion (Figure 70). In addition, non-fossil fuel sources produced 2.3 percent of the total pollutants mainly due to cement production. Methane ($CH_4$) accounted for 6.4 percent of the total pollutants generated primarily from landfills, enteric fermentation and manure management. Nitrous Oxide ($N_2O$) accounted for another 6.8 percent largely due to mobile source combustion and agricultural soil management. Finally, other gases with high global warming potentials (GWP) accounted for the remaining 3.5 percent. These high GWP gases include use of substitutions of other gases (hydrofluorocarbons or HFCs) for ozone-depleting gases, electricity transmission and distribution (Sulfur Hexafluoride or $SF_6$), and semiconductor manufacturing (perfluorocarbons or PFCs and $SF_6$). It should be noted that the percentages of climate change pollutants associated with each gas were generally stable over the 1990 to 2002 period, except that the high global warming potential gas percentage rose somewhat.

Figure 69

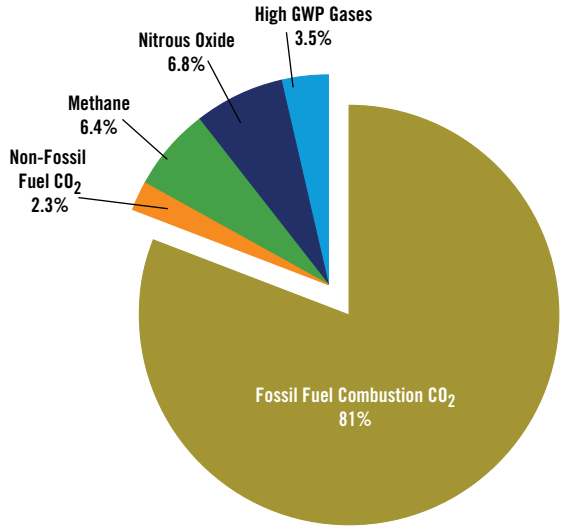
**California Climate Change Emission Trend and Reduction Targets**
Million Metric Tons ($CO_2$ Equivalent)




*Source: California Climate Action Team Report, March 2006*

Figure 70

## California Composition of Gross Climate Change Pollutants, 2002




**GWP: Global Warming Potential*

*Source: California Climate Action Team Report, March 2006*

Among the different sectors in California, transportation is the largest source (41.2 percent) of climate change emissions followed by the industrial sector (22.8 percent). Electricity production, from both in-state and out-of-state sources, was the third largest source at 19.6 percent. The SCAG region is likely to have the similar pattern as the state.